New Strategy for Success in Hydroelectric Automation

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Summary

The use of automation to improve the operation of hydroelectric generators is a topic that has produced many stories of failure. This may be a result of so much being promised and so little delivered. Whatever the reasons, the North Pacific Region of the Corps has embarked on a new strategy in the hope of achieving success. This paper provides an overview of the strategy.

Background

Computer based automation systems have been applied to hydroelectric control at various projects since the 1960's. Although the technology has advanced greatly from that time, the way in which systems have been implemented by the Corps has remained mostly unchanged. Once funding is obtained, the design work is assigned to the Hydroelectric Design Center (HDC). HDC prepares a set of plans and specifications for a contract that results in the implementation of the automation system. Depending on HDC's resources, the software development is accomplished by either HDC, a contractor or a combination of both. Once the automation system is delivered and installed, it is turned over to operations. Acceptance of such systems has been met with skepticism, mostly due to the lack of involvement by operations. To make matters worse, there are often deficiencies in the systems at the time they are turned over to operations. With funds typically running low at this point, the contractor and HDC leave the scene and the situation rapidly degrades into one of long term disgruntlement.

Another reason that automation systems have often not met expectations is that they relied too heavily on proprietary designs. Early systems used off-the-shelf minicomputers that were pre-configured with custom software and I/O interfaces to meet specifications. Whenever a portion of these systems became unsupportable, the whole system required replacement. It is often difficult for a project manager to understand why an automation system requires total replacement after only a few years while other

equipment (e.g., circuit breakers, transformers, turbines, etc.) lasts for 30 years or more.

By the mid-1990's, the North Pacific Region had many aging automation systems that begged for replacement. Although there was a need to replace the equipment with new PC based systems, the shrinking O&M budgets prevented any significant effort from getting underway.

In March 1996, it became evident that the concern went beyond the boundaries of the North Pacific Region. HQUSACE arranged a meeting regarding Supervisory Control and Data Acquisition (SCADA) in Omaha, Nebraska. Many good discussions took place on such topics as the use of off-the-shelf hardware and software. For the North Pacific Region, however, it was somewhat of a moot situation because of the lack of adequate funding to use on new automation systems.

The Opportunity

In July and again in August of 1996, power system disturbances in the WSCC region brought attention to the need for better communications and control. The power marketing administration (PMA) for the Northwestern states is Bonneville Power Administration (BPA). In an effort to prevent similar occurrences in the future, BPA asked the Corps to come up with a plan to improve the reliability of the powerhouses. Funding for these improvements would be provided by BPA. Because of the need for powerhouse data during a system disturbance, making the powerhouse automation equipment reliable became one of BPA's highest priorities.

Implementation

A meeting was held in December of 1996 to plan a strategy regarding the automation systems. It was decided to replace existing DACS equipment at the Bonneville, The Dalles and John Day powerhouses and to add a DACS system at the McNary powerhouse. Existing automation equipment at The Dalles and John Day fails frequently although it is less than ten years old. Existing equipment at Bonneville has less failures, but is nearly 20 years old, and difficult to find parts for. Addition of an automation system at McNary has been proposed for several years, but adequate funding has never been available. With four projects involved, it seemed apparent that some efficiency could be gained with a common effort.

In order to oversee the effort, a team was formed. Existing automation systems at the projects are called Data Control and Acquisition systems (DACS). So the team was christened the "Generic DACS Team." The team includes representatives from a diverse group of organizations (HDC, project staffs, BPA, etc.). At that first meeting, a team charter was established and signed by each of the members. The charter states (in part) that the end systems shall have the following characteristics:

- Off the shelf hardware and software.
- Modular, fault tolerant and robust in order to prevent a single component from causing system failure.
- Utilize industrial grade enclosures and components for critical subsystems.
- Application software shall be well documented and become property of the Corps.
- Use industry standard interfaces when possible.
- Committed to producing a user-friendly system.
- Will meet present needs and future growth requirements.

Meetings have been scheduled once every month thus far. Much of the initial effort was placed into developing a schedule for implementation at each project. After much exhaustive effort to meet the needs of all team members, a proposal was submitted to BPA in May of 1997. Shortly thereafter, a formal agreement was made between the Corps and BPA in which BPA agreed to fund the entire effort.

Once the agreement was signed, the team went to work on the design issues. Subcommittees were formed to address those issues that are too complex or large to take care of in the monthly meetings. The subcommittees were opened to both members of the work group and to others who are interested. Subcommittees formed thus far include the following:

- database
- fiber optic
- system maintainability
- configuration management
- security and interconnectability
- marketability
- software

The subcommittees provide feedback during the monthly meetings, providing information and recommendations to the DACS team for action and approval.

The schedule calls for two units at McNary to be placed on control and tested by November of 1998. The remaining units at McNary will be placed on control by October of 1999. The other projects will follow closely behind.

Conclusion

Although it is too early to claim success, there is a great deal of optimism that it is within reach this time. Key factors regarding the new approach include:

- Use of off-the-shelf hardware
- Use of off-the-shelf software (for functions that have commercial product offerings)
- In-house development of application software (for functions that have no commercial product offerings)
- Involvement of all stakeholders throughout the development process

With several additional projects within North Pacific Region in need of new automation systems, there is much interest in the results of the generic DACS effort.